

66. *Devonian Fossils from Heitai, Mishan-hsien, Manchoukuo ; Second Note.*

By Hisakatsu YABE and Toshio SUGIYAMA.

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In the December number of these Proceedings Vol. XVI, 1940, the senior author¹⁾ reported on a collection of Devonian fossils from Heitai (Kokudai), Mishan-hsien, in Manchoukuo, which comprised *Spirifer* (*Adolfia*) sp., *Atrypa aspera* (Schlotheim), *Leptaena rhomboidalis* (Wilckens), *Favosites* sp., and *Lioclema* (*Lioclemella* ?) sp., besides a trilobite-pygidium which being then generically indeterminable was left unmentioned. As to the geological age of this faunule, the author considered it to be Upper Devonian, stressing the occurrence of a spiriferid of the *Adolfia*-type.

This spiriferid referred to *Adolfia* is a big form, some 50 mm high and more than 80 mm broad, while the common species of *Adolfia* are much smaller; above all, there are two features of the brachiopod that had escaped the attention of the senior author, namely, (1) the relatively wide-angled delthyrial space of the cardinal area, and (2) the pustules on the shell surface, which are arranged concentrically rather than pinnately, on radial lines—three important points that enable this fossil being assigned to *Plicatospirifer*, not to *Adolfia*, as lately suggested by the junior collaborator of the present article.

In the meantime, Prof. T. Nagao, at the request of the senior author, visited the fossil locality and made a new collection which he kindly submitted to the present authors for examination. In its fossil contents, this new material is almost the same as the previous one, having but few additional elements; the close similarity of the first and second collections with respect to the composing elements probably indicating that the faunule of the fossiliferous deposit is not a rich one, or has, at most, only a few dominant elements represented in both collections.

Strange to say, the two collections are supplementary in several respects, the spiriferid in question being represented by two pedicle valves only in the first collection and by three brachial valves only in the second; the *Favosites* in the first collection is a colony with well preserved surface, but its internal structure almost obliterated, whereas in the second collection, it is represented by good specimens with excellently preserved internal structures. Although *Lioclema* occurs in the first collection, it does not in the second, while there is another spiriferid in the second collection, that is not represented in the first, and positively differing from the other spiriferid just mentioned, which last, however, is not yet specifically determined. As to the trilobite we have unfortunately only a pygidium in each collection. Although

1) H. Yabe: An Occurrence of Devonian Fossils in Manchoukuo. Proc. **16** (1940), 556.

it is probably a *Proetus*-like form, nothing more definite can be said about it at present. The revised list of the Devonian fossils from Heitai follows:

	1st Coll.	2nd Coll.
<i>Plectospirifer grabau</i> , sp. nov.	×	×
<i>Spirifer</i> , sp. indet.	—	×
<i>Atrypa aspera</i> (Schlotheim).....	×	×
<i>Leptaena rhomboidalis</i> (Wilckens)	×	×
<i>Favosites multispinulosus</i> , sp. nov.	×	×
<i>Lioclema</i> (<i>Lioclemella</i> ?) sp.	×	—
<i>Proetus</i> -like form, gn. et. sp. indet	×	×

Important for determining the age of the fossil faunule is *Plectospirifer grabau*. All the species of *Plectospirifer*, founded by A. W. Grabau¹⁾ on *P. heimi* Grabau from Szechuan, are derived from the Middle Devonian. Although the Manchurian species is nearest to *P. fongi*²⁾ Grabau from the Givetian of Kwangsi, the former differs from the latter by being much larger in size, with greatly extended hinge-line, and by bearing less prominent or rather depressed ribs or plicae; these three features being the characteristics according to Grabau, of the phyletically advanced members, this species, and consequently the faunule with it, cannot be older than the Upper Middle Devonian (Givetian).

Favosites multispinulosus closely resembles a certain species from the Devonian of Eifel, Germany, stored in the Natural History Museum of Paris, which M. Lecompte³⁾ once described under the name "*Favosites polymorpha*" M. Edwards et Haime.

In the former report, the fossil locality was given as "Heitai, in the Mishan coalfield, Mutanchiang-hseng." The following additional details the present authors owe to the courtesy of Nagao.

The railway station, Kokudai (Heitai⁴⁾) on the Korin⁵⁾ (Korin-Rinko⁶⁾) line, lies close to the Mishan coalfield, the hill where the fossiliferous deposit is exposed lying some 8 km (along the road) NE of the station; politically, Heitai, as well as the fossil locality, belongs to Mishan-hsien⁷⁾, which formerly belonged to Mutanchiang-hseng⁸⁾, but now belongs to Tungan-hseng⁹⁾. (Fig. 1).

The fossiliferous rock is a calcareous sandstone, some 20 m thick, which in places, is so calcareous as to be called limestone. It is overlain by a massive arcose sandstone, which is partly conglomeratic, being rich in white quartzite pebbles, and overlain successively by a coarse

1) A. W. Grabau: Studies for Students. Ser. I, Palaeontology, Brachiopoda. Sci. Quart. Nat. Univ. Peking, vol. 2, p. 32, 1931. Devonian Brachiopods of Southern China. Pal. Sinica, ser. B, vol. 3, fasc. 3, p. 379, 1933.

2) A. W. Grabau: Op. cit. (1933), p. 380, pl. 40, figs. 12 a-f.

3) M. Lecompte: Revision des tabulés Dévonien décrits par Goldfuss. Mém. Mus. Roy. Hist. Nat. Belg., no. 75, p. 102, 1936.

4) 黑臺.

5) 虎林.

6) 林口.

7) 密山縣.

8) 牡丹江省.

9) 東安省.

sandstone, an alternating series of black shale and fine sandstone, and a green tuff; the last mentioned being exposed on the down slope of the hill on its southwestern side. The whole complex strikes east to slightly south, with a dip 40° to southwest. It is a member of the

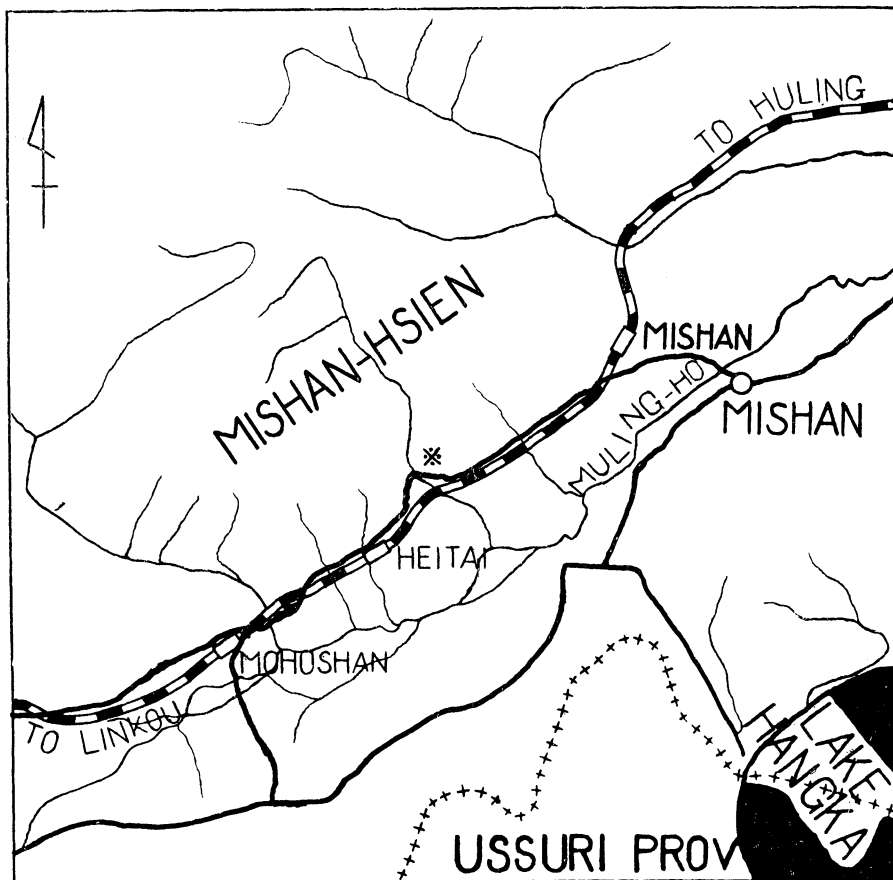


Fig. 1. Fossil locality * near Heitai, Mishan-hsien.

foundational formations or one of the formations underlying the Jurassic coal measure of the Mishan coalfield, although no direct stratigraphical contact of the complex in question and the coal measure has yet been observed.

Plectospirifer grabaui, sp. nov.

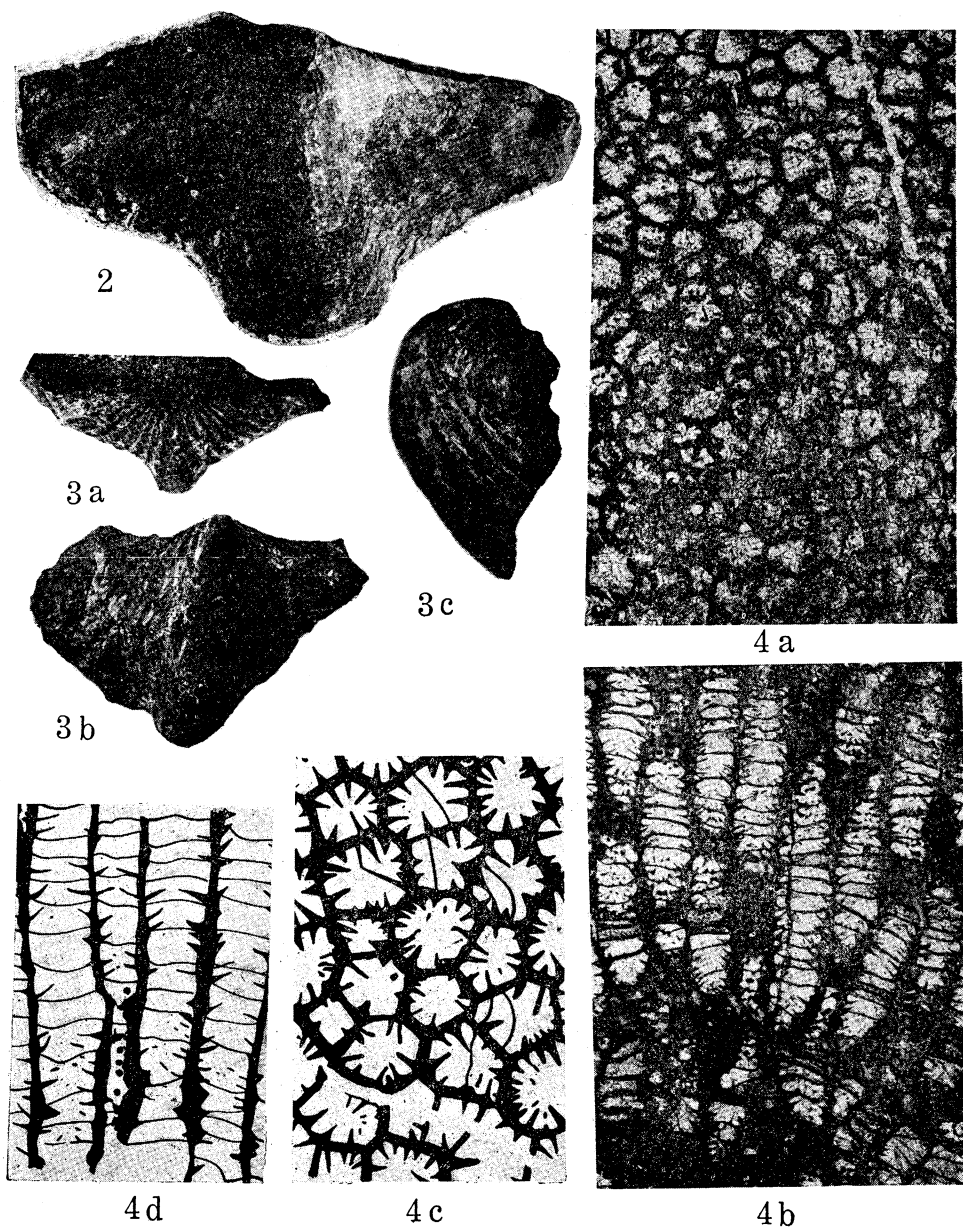
Figs. 2, 3 a-c.

1940. *Spirifer* (*Adolfia*) sp. Yabe, op. cit., pp. 556-557, text-figs. 1 a-c.

The original description reads:

"Two incomplete pedicle valves, the larger and best is figured. Shell some 50 mm high and more than 80 mm broad, both cardinal extremities broken off; transversely elongate, moderately convex. Beak depressed, incurved and somewhat overhanging hinge area which is 1 mm high, nearly flat, apparently smooth, provided in its middle with a broad triangular delthyrial space measuring 20 mm at its base; shoulder angle rather sharp. Sinus pronounced, broad and deep, beginning at beak and prolonged

anteriorly in tongue-like fashion; rounded on both borders, divided mesially by a thin, but distinct raised line in apical part, growth-like distinct. Radial plicae some 10 on either side of sinus, flat and alternated with narrow interspaces or rather thin depressed lines; innermost plica on inner slope of rounded border of sinus faint, being



Figs. 2-3. *Plectospirifer grabaui*; brachial valves. $\times 1$.

2, largest specimen; 3 a-c, another, smaller specimen in three different views.

Figs. 4 a-d. *Favosites multispinulosus*.

a, transverse section, $\times 5$; c, the same, \times ca. 9; b, nearly longitudinal section, $\times 5$; d, the same, \times ca. 9.

weaker than others. Shell structure fibrous; whole surface covered with minute pustules more or less linearly arranged, being particularly distinct on surface of sinus."

There are three brachial valves now at the authors' disposal. In the largest and best preserved valve (Fig. 2), the apical part and the right cardinal extremity are lacking; these when restored, it measures some 80 mm in breadth, 50 mm in height and 30 mm in depth. Very obtusely triangular in general outline, moderately convex. Hinge-line straight, nearly equal to or slightly shorter than the maximum breadth of shell, area low. Cardinal angle rectangular. Mesial fold large, 25 mm broad on anterior margin, highly elevated, prolonged forward tongue-like; deprived of test, and showing on the anterior part of inner mould faint traces of more than 15 radial plicae, almost 1 mm broad, apparently simple, smooth, flat, or scarcely convex, and separated from one another by depressed lines. Radial plicae on either side of mesial fold simple, slightly broader than interspaces, both becoming gradually obsolete toward cardinal extremities. Surface of shell covered by growth-lamellae and very fine radial striae, latter growing to minute, but distinct, more or less radially elongated pustules at the intersection with the former. Shell structure fibrous.

In another brachial valve (Figs. 3 a-c), apical part well preserved, beak small, incurved, slightly overhanging; hinge area low, vertically striated. At apex, mesial fold hardly stouter than other plicae, but thence rapidly enlarging anteriorly.

Internal structure of all the valves, both pedicle and brachial, quite unknown.

Remarks: In *Adolfia*, the surface of the shell is minutely pustulated, and the pustules are, as stated by W. Päckelmann¹⁾, radially and alternately arranged divergent short tubules that are raised at their anterior ends, while in *Plectospirifer*, it is, to quote Grabau, "covered by regular concentric lamellae which are radially striated, and in some cases produce a fine beading on the margin²⁾." In this and all other features, the present species resembles *Plectospirifer* more than *Adolfia*.

Of several species of *Plectospirifer*, *P. fongi* Grabau, from the Middle Devonian Peima Shale of Kwangsi, most resembles the present species; but the latter is distinguished from the former by its larger shell, very extended hinge line, broader cardinal area, rectangular cardinal extremities, anterior part of mesial fold in pedicle valves, more prolonged, less elevated radial plicae in alternation with shallower interspaces, and numerous narrow radial plications faintly impressed on the mesial fold of the brachial valve. It is a new species distinct from all the species so far known of *Spirifer*, s.l.

Favosites multispinulosus, sp. nov.

Figs. 4 a-d.

1940. *Favosites* sp. Yabe, l.c., p. 557.

Corallum massive, more than 12 cm in diameter. Corallites poly-

1) W. Päckelmann: Versuche einer zusammenfassenden Systematik der Spiriferidae King. N. Jahrb. M.G.P., BB., Bd. 67, Abt. B, p. 46, 1932.

2) A. W. Grabau: Op. cit., (1931), p. 29.

gonal, rather uniformly broad, relatively narrow, 1 mm broad, mostly hexagonal in cross-section; wall rather thick, averaging 0.1 mm; mural pores about 0.1 mm wide, uniserial, mesial, or submesial; tabulae crowded, 5 or 6 in 2 mm, somewhat uneven; in general, horizontal; septal spines numerous, arranged in vertical rows up to 20 in number, variably long, some extending to near the centre of corallites and the others to half way, all directed obliquely upward.

Remarks: In its narrow, relatively uniform corallites with crowded tabulae and numerous well developed septal spines, this species closely resembles "*Favosites polymorpha*" M. Edwards et Haime from the Middle Devonian of Eifel, Germany, as illustrated by M. Lecompte in 1936. The former, however, differs from the latter in having more numerous and slender septal spines, being very similar in these respects to *Favosites hisingeri* M. Edwards 'et Haime, from the Gotlandian, although quite different in other features.
